Developing a Pavement Maintenance Program

We are providing this guidance to assist an airport Sponsor with developing an effective pavement maintenance program (PMP) for their airport. This guide **does not** provide a complete program the Sponsor can immediately apply to their airport. This Sponsor may use this information to develop their airport specific PMP. Larger facilities will likely require a more extensive program to ensure proper tracking of the maintenance data.

Each airport should customize the collected information to best fit the needs, conditions, and resources of the airport. This information should allow an airport to develop an initial program that can evolve over time. As with all successful endeavors, the maintenance program must be provided with sufficient resources and commitment if it is to succeed.

1. General Information

Provide a short narrative that describes the general location of the airport and any known geological or meteorological conditions that may affect the life of a pavement structure (e.g. shallow water table, poor soil properties, extreme freeze/thaw periods, etc). Include any information that may assist with the maintenance effort.

2. Inspection Schedule

The frequency of pavement inspections will greatly depend upon available resources; however, an effort must be made to provide a regular cycle of observations to track the condition of the pavement.

It is not necessary to provide a complete inspection of the entire airport during each inspection period. The FAA requires, as a minimum, that a complete and detailed inspection be performed at least once a year (3 years for PCI survey), and a drive-by inspection be performed a minimum of once per month to detect unexpected changes in the pavement condition.

Many successful programs provide daily, weekly, monthly, and/or annual inspection frequencies. The intensity of each inspection varies with the frequency. The daily inspection may provide for simple FOD detection, minor surface defects, and obviously dangerous pavement distresses, e.g. blow-ups, erosion. The weekly, monthly and annual reports increase in intensity and ultimately provide inspection of all or a statistical sampling of all airport pavements.

Establishing forms for each inspection type will assist the inspector with identifying the type of data to report and level of effort needed to obtain the data. The development of a checklist or fill-in-the-blank form will reduce or eliminate some of the individual differences between inspectors. Properly completed forms will provide uniformity and consistency to the inspection reports.

3. Pavement Inventory

The Pavement Inventory section defines the structure of the pavement and separates the airfield into smaller manageable elements of pavement. The construction history of each element should be identified along with any unique pavement features. For convenience, all pavements should be broken into elements and mapped for reference.

A map or plan view of the airport should identify all pavement elements. The map should allow the individual performing maintenance inspections to quickly reference the pavement element by name and location.

To assist in tracking the various pavement elements, we recommend numbering the elements and logically grouping them together. For example elements 1,2,3 & 4 may be from a runway, therefore the sections may be labeled, R1, R2, R3 and R4.

In addition to logical proximity, the map system should also consider the condition and special requirements of a given pavement element. Elements of similar condition, use, and structure may be grouped together and statistically sampled.

When determining and grouping pavement elements the following features should be considered

A. **Pavement Type:** Pavement type refers to the stress distribution mechanism provided by the pavement structure. Typically, pavement types can be categorized in three classes; Rigid, Flexible, and Overlays. Rigid pavements are normally constructed of Portland Cement concrete and use the stiffness of the concrete slab to distribute the applied loads. Flexible pavements are usually constructed using bituminous products and depend upon the bearing capacity of the structural layers to distribute applied load. Overlays are simply combinations of pavement types.

B. **Pavement Materials and Base Characteristics**: All pavement structures are designed in layers of progressively stronger materials. These layers usually consist of the surface course, base, subbase(s), and subgrade. The surface course is defined as the uppermost layer that makes direct contact with wheel loads. The layer of material directly under the surface course is considered as the base course. Under the base course is the subbase and under the subbase is the subgrade (natural soils).

   The type of material in each layer and the thickness of the layer will directly affect the strength of the pavement. Sections of pavement that have an identical surface course but different base materials may perform differently and should not be categorized together unless additional information is available to indicate that the pavement structures are similar. Likewise, different subgrade soils may perform differently and should be considered when categorizing pavement sections.

C. **Drainage Characteristics:** The amount of moisture within a pavement layer will greatly affect the strength and thereby the performance of the layer. As the moisture content of a layer increases, the strength decreases. If subsurface drainage is provided, the overall strength of the pavement section will be higher.

   Some pavement sections have drainable layers built into the structure for additional drainage capacity. These drainage features should be strongly considered when grouping pavement sections.

D. **Age of Pavement**: Due to variations in construction and material quality, the age of a pavement structure may not accurately indicate the condition or the performance of the pavement. However, the age of the pavement may be used to further categorize pavement sections and can provide a relative condition of those sections.

E. **Pavement Usage:** Other than deterioration from the adverse affects of weathering, the loads applied to a pavement are the most destructive force that the pavement must withstand. Areas of high and low usage will ultimately determine areas requiring the

most or least maintenance. Additionally, areas of high usage readily indicate critical pavements that should receive a high priority in the maintenance schedule.

F. **Allowable Pavement Load - Pavement Strength:** Destructive overloads can be avoided by identifying and mapping the pavement loading restrictions. Gross overloads can do unseen damage to a pavement structure that will require substantial repair at a later date. By routing traffic over the proper pavements, maintenance repairs can be reduced.

The actual description of each element will echo the pavement features noted above. The description is really the key source of information regarding the history and structure of the pavement. Bullet headings are the easiest to follow and provide the quickest source of information. We suggest the following headings and recommend that they be provided for reference as a legend:

NAME OF ELEMENT (or other means to identify the pavement section)

A. Pavement Structure Type: (e.g. flexible, rigid, overlay)
B. Pavement Surface Material: (e.g. asphalt, concrete, asphalt with slurry seal, etc.)
C. Pavement Inventory: - List each layer of the pavement element including dates of construction. For example:
   - 3" Asphalt overlay -FAA Item P-401 (1997)
   - 8" PCC -FAA Item P-501 (1980)
   - 6" Aggregate Base -FAA Item P-209 (1980)
   - 12" Treated subgrade - FAA Item P-155 (1980) Include soil type and features.
D. Drainage Features: (subdrains, drainage layers, surface drainage only)
E. Pavement Use: Be as specific as possible, however, even general usage categories such as low, medium, and high will provide valuable information. The intent is to know how often and how severely the pavement is loaded. A pavement with high use will justify quicker maintenance action.
F. Pavement Strength: (allowable wheel loads)
G. Priority: (A system of how important this pavement is relative to other pavements on the airport)
H. Miscellaneous Information: This item may contain information that can assist in determining the cause of a distress or any other relevant information that will assist in the maintenance effort.
I. Related History and Inspection Data: The pavement information provided in the above items should only reflect the current pavement section. Previous rehabilitation or maintenance of the pavement should be kept in a history file for the section. Since this file will grow in size, you may want to attach it as an appendix. Some rehabilitation work will appear in the above items such as; addition of pavement layer, change in surface material, etc. The Sponsor should update each elements item when appropriate.

4. Distress Identification Index

To assist the inspector in identifying distress features for remedial repair, provide a listing of distress types, including photos and descriptions. Keep in mind that the inspector may not be technically aware of all pavement distress features.

Inspectors have in the past listed alligator cracking on an apron. Alligator cracking is generally associated with sub-base failure. However, the different thermal properties of a slurry seal and asphalt surface can result in peeling and curling of the seal coat in a similar alligator cracking. In this case, the sub-base has not failed but inspectors report may indicate as such. A short description of this distress may prevent such a mistake. There are numerous references available to provide distress descriptions, including AC 150/5380-6 appendix B, and various FHWA publications.

A few important items that are somewhat less obvious than the standard pavement distresses but still need to be included in the maintenance program are:

- Sub-drain outlets - Are they clean, can moisture escape the outlet?
- Weed control - Prevent weeds and grass growth in all cracks.
- Surface Friction - Does the pavement appear to have adequate friction? Have pilots reported a problem? See AC 150/5320-12 for additional information.
- Vegetation growth buildup - Does vegetation along the edge of the pavement prevent moisture from escaping the pavement surface?
- Painted Surfaces - Is the quality of the painted surfaces sufficient?
- Unsafe conditions - Excessive edge drop, bumps and depression, ponding, etc.

5. Inspection Reports

Remember that the inspection report is your best source of information for pavement condition. Provide the inspector with sufficient instructions to complete the report in a manner that will provide useable information. You may want the inspector to identify the distress, locate it on a map, note any unique conditions, and possibly make recommendations regarding repair. All reports should be dated and include the name of the inspector.

To assist the inspector and to assure that you obtain the data you desire, it is best to provide a standard form that can be simply filled-in. As a minimum, the form should provide space for the following items:

- Basic data - Date, location, element name, inspector name etc.
- Distress - Type and condition of each distress identified.
- Action Plan - Actions to be taken to correct each distress.
- Follow up - Complete when repair work noted in action plan is finished.

Each identified distress should be provided with an action plan. It is an acceptable action to monitor a distress, however, to be effective, the noted distress must be identified and intentionally monitored. For distress features that need immediate repair, the action plan needs to be very specific. The action should identify the “who”, “how”, and “when” for repair of the distress.

It is likely the inspector does not control the correct action for a distress. To assist the inspector, the inspection program should provide basic guidelines for remedy. These guidelines may take a simple form such as "identify all unsealed cracks and report for inclusion in the next crack sealing effort" or "identify pot holes and report for immediate repair by city forces".

However presented, instructions should provide simple procedures to allow the inspector and airport management to properly address the distress in a timely manner. A tracking procedure should be established to assure that each identified distress is addressed and repairs noted in the program.

6. Economic Analysis and Prioritizing System

Track the cost of maintenance for each pavement group over time. As the condition of the pavement deteriorates over time, the cost of doing maintenance will increase. Eventually it will be more cost effective to rehabilitate or reconstruct a section of pavement than to perform continual maintenance. Cost comparisons should include both initial and anticipated costs of the alternatives throughout the expected life of the pavement. In all cases, the cause of the distress should be determined first, and then repairs can be made to not only correct the present damage but to prevent or retard its progressive occurrence. All repairs should consider the long-term effects rather than short term fixes. It is much cheaper to make the correct repair once than to continually make the wrong repair.

Since maintenance dollars are often limited, a fair and comprehensive prioritizing system should be outlined. Areas of high traffic should receive a higher priority since the additional traffic will cause additional damage and the additional traffic indicates user needs. Areas of low traffic may not deteriorate as rapidly and may require less overall maintenance. This does not implicate that areas of low usage can be ignored. The maintenance performed on any section of pavement should meet the preventive maintenance requirements for that section.

7. Program Funding and Programming

Along with when and how each distress is addressed, it is important to identify the necessary funding source. If the program does not address funding it will fail. There will always be some type of distress that needs either a preventive or remedial action. It is extremely important that funding sources be known, otherwise, it is impossible to plan maintenance efforts and the necessary maintenance is delayed. If funding is not identified, the distress may advance to a condition where repairs are required to keep the pavement open. In most situations, delay in addressing the maintenance needs of the pavement result in higher overall costs.

Reliable funding will allow an airport to program maintenance efforts and allow the timely and cost effective coordination of work. For example, it makes good sense to delay crack sealing for a few months if a sealing program is scheduled on a regular basis. This allows an inspector to identify the crack and note it for sealing at the next interval. This reduces the sealing cost per crack and minimizes exposure for possible damage to the pavement.

A maintenance program is often targeted for remedial maintenance and does not consider the need for preventative maintenance. It is correct to provide inspections for distress features, which will require immediate attention, however, the inspections should also be performed with the intent to identify pavement conditions, which warrant preventative treatments. Be sure to include preventive actions in the maintenance program and the maintenance budget. In order to obtain the necessary funding it may be necessary to include preventive measures in a projected budget of 1 to 3 years. Many maintenance measures are cyclic in nature and should be included in projected budgets even if the associated distress in not readily apparent.

A comprehensive maintenance program should be developed and updated annually, featuring a time schedule and listing of equipment and products required. Remedial and preventive maintenance actions should be made systematically each year to the extent necessary. Include the resources, (time, personnel, equipment, products, pavement closures) necessary and an estimate of the total cost for each maintenance item. When properly prepared, such a maintenance program will not only assure proper and timely maintenance but can also be used to justify the necessary funding.